

Pelagic Habitat Analysis Module (PHAM) for GIS Based Fisheries Decision Support

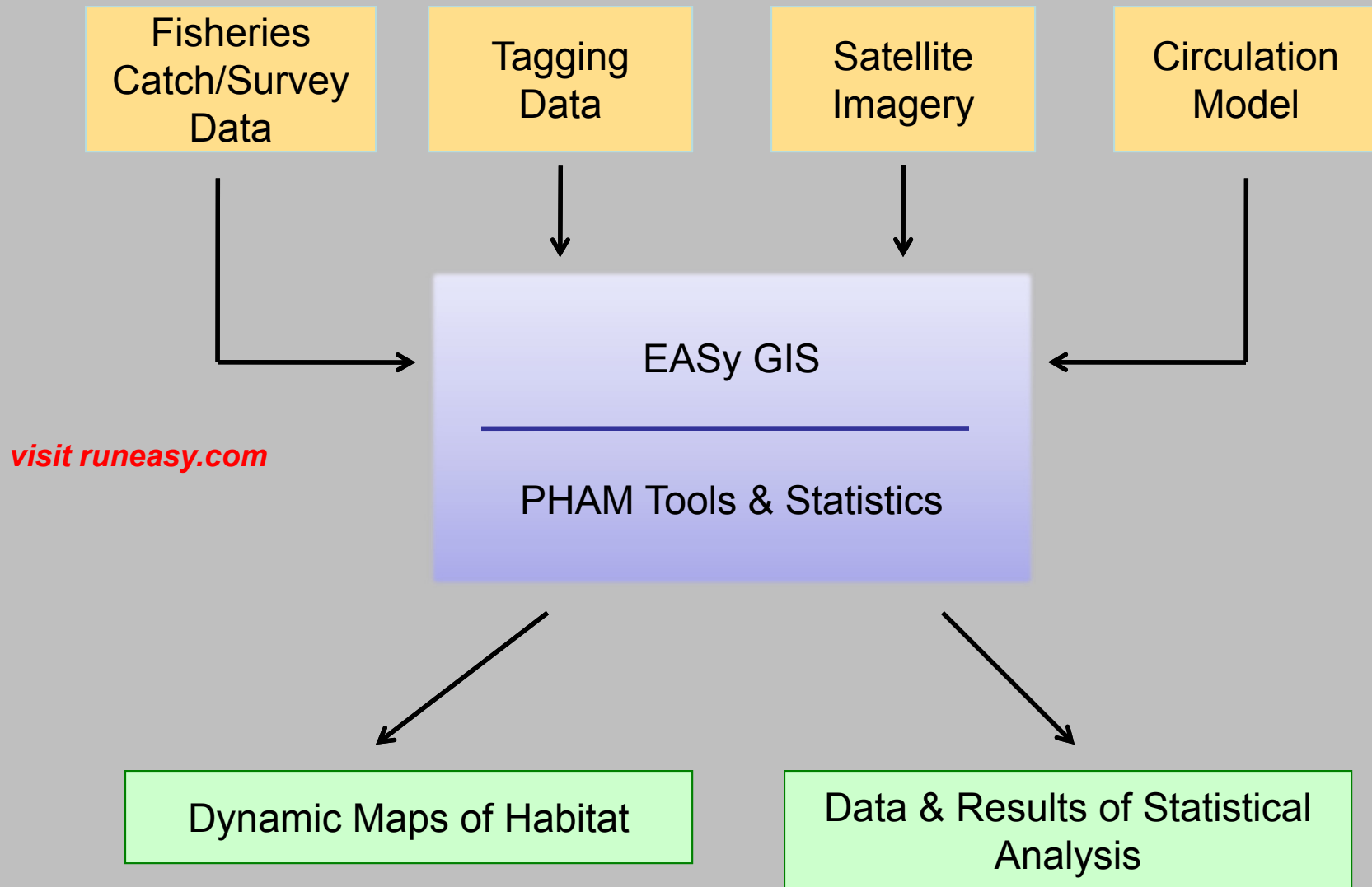


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Pelagic Habitat Analysis Module (PHAM)



Improving Fisheries Management

Stock Assessment / By-catch

Tuna of the EPO

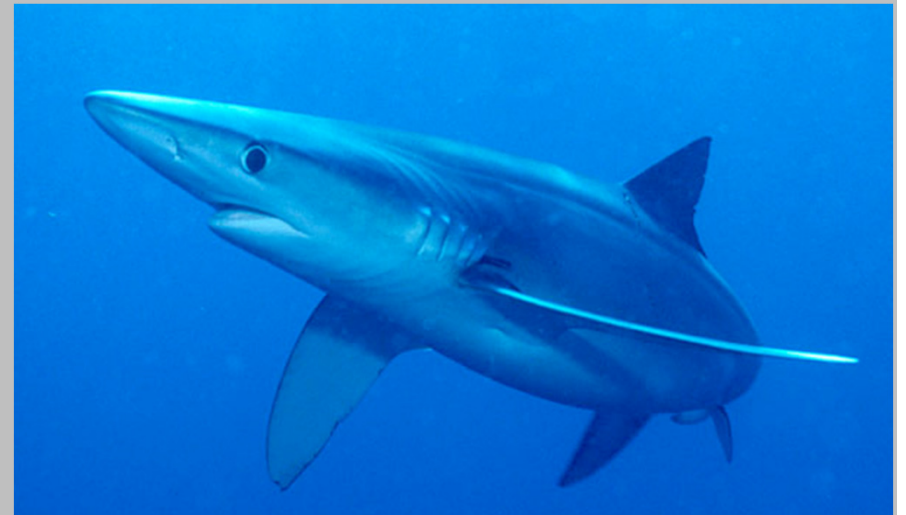
- Important Commercial Species (\$2-3 B annual revenues Eastern Pacific)
- Stock assessment models only provide a reliable estimate of recruitment several years after the fact
- Very little (if any) environmental data used in stock assessment models

Sharks of the California Current

- Stock assessment model for Thresher Sharks – Input from PHAM GAM
- By-catch Management – Where does habitat overlap commercial fishing?
- Distribution of pregnant females



Mako Shark (*Isurus oxyrinchus*)



Blue Shark (*Prionace glauca*),



Common Thresher Shark (*Alopias vulpinus*)

Fisheries Data

- Survey Data
- Commercial Catch Data
- Vessel Logbook Data
- Recreational Fishing Data
- Tagging data (not yet)

Environmental Characteristics

Satellite Imagery

- Seawifs Chl
- Modis Chl
- Modis SST
- GHRSSST
- AVHRR SST
- AVISO SSH
- Quikscatt Winds
- NOAA Coastwatch Frontal Probability
- NSA JPL Frontal Probability
- EPTO Bathymetry

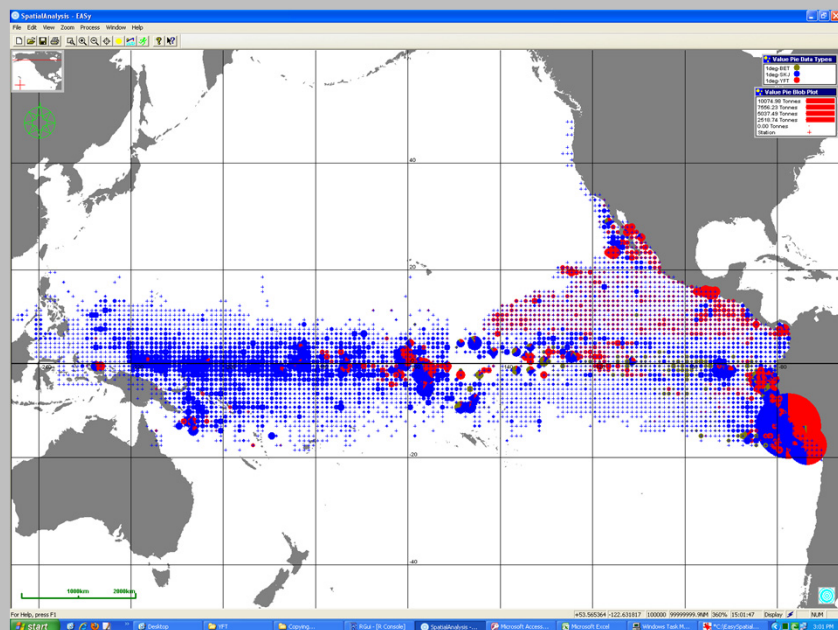


NASA ECCO 2 Model

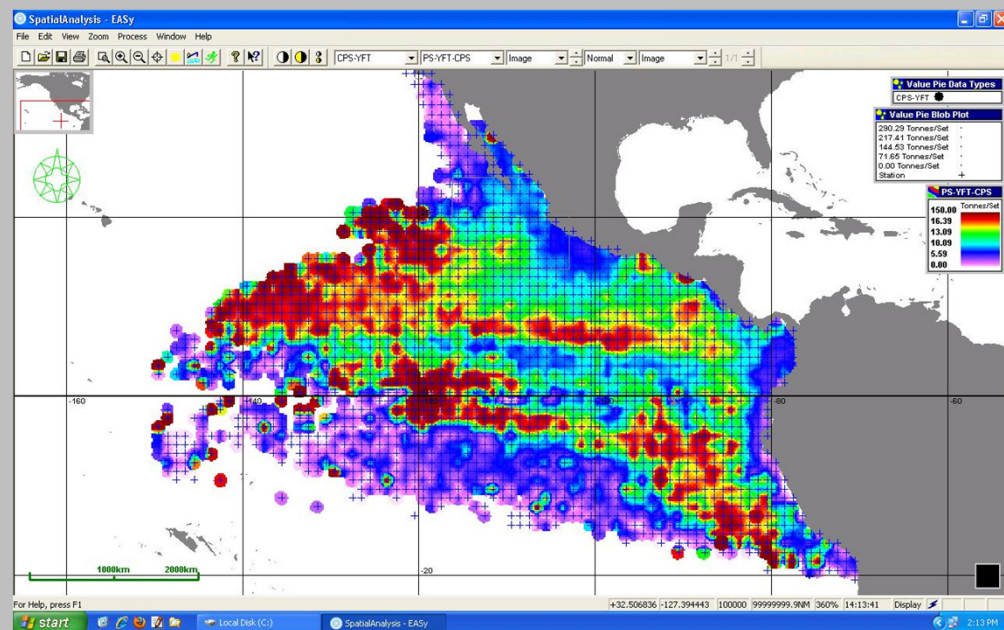
- Mixed Layer Depth
- SST
- Temperature at Depth
- SSH
- Sea Surface Salinity
- Currents

EASy Built In

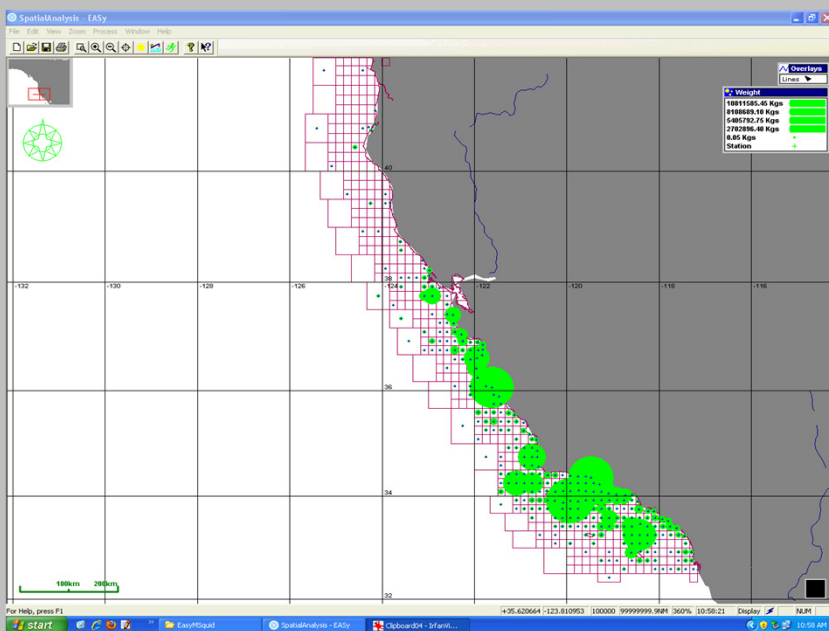
- Earth Magnetic Field
- Longitude
- Latitude
- Month



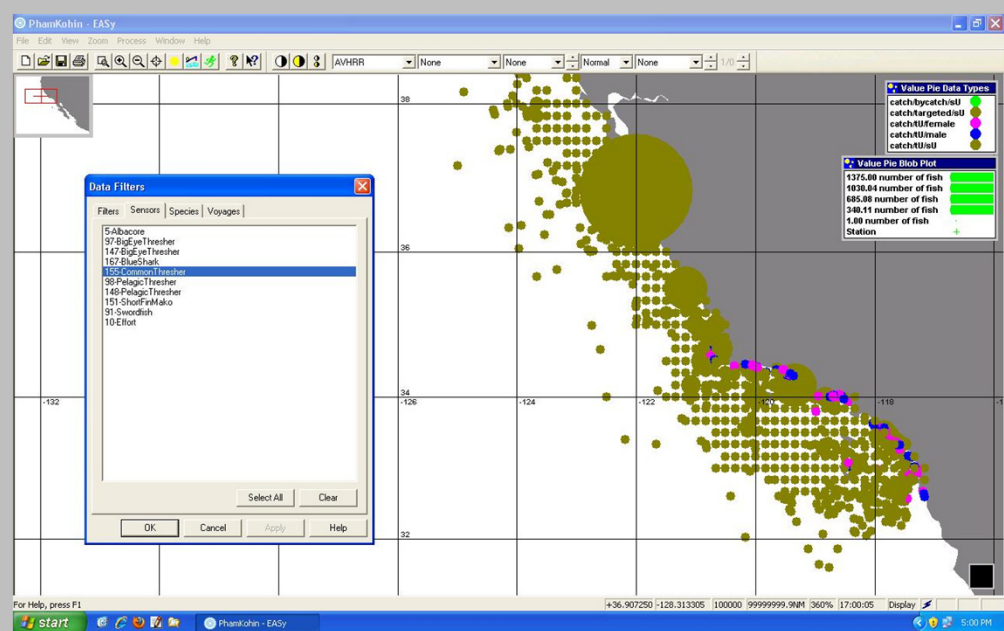
Average catch per set (Purse Seine) Tuna, IATTC 35yrs



Average catch per set (Purse Seine) for Yellowfin Tuna, IATTC 35 Yr Timeseries

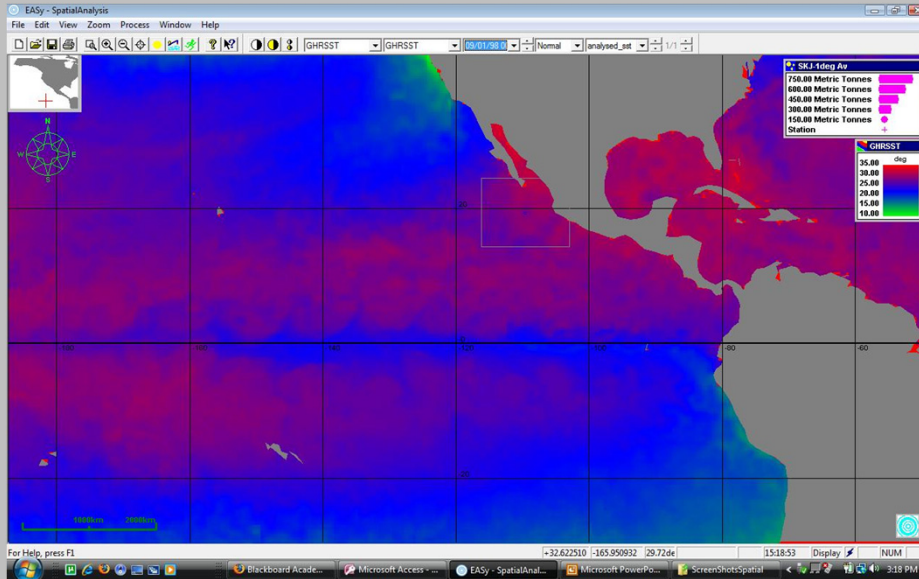


Average Catch Market Squid

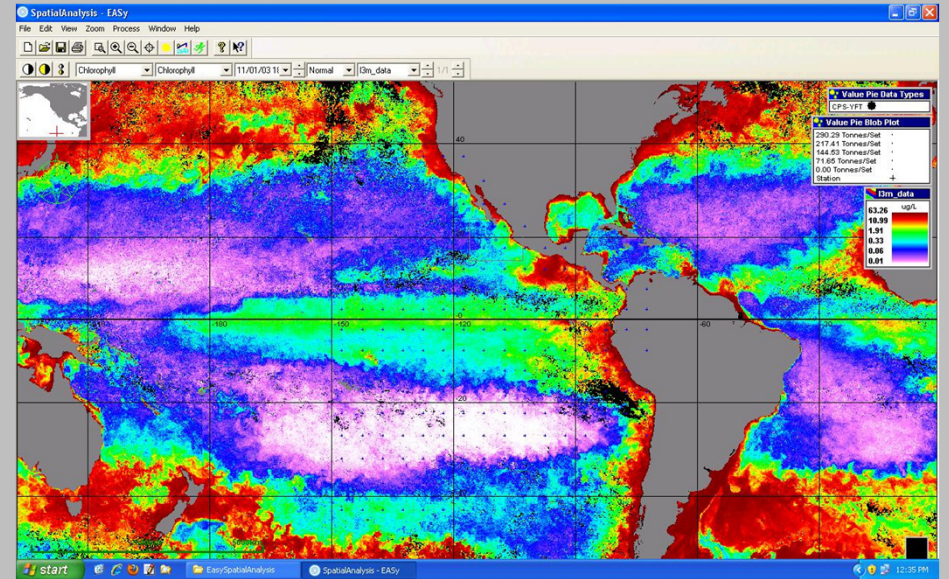


Average Catch Number by Sex – Common Thresher Shark, SWFSC

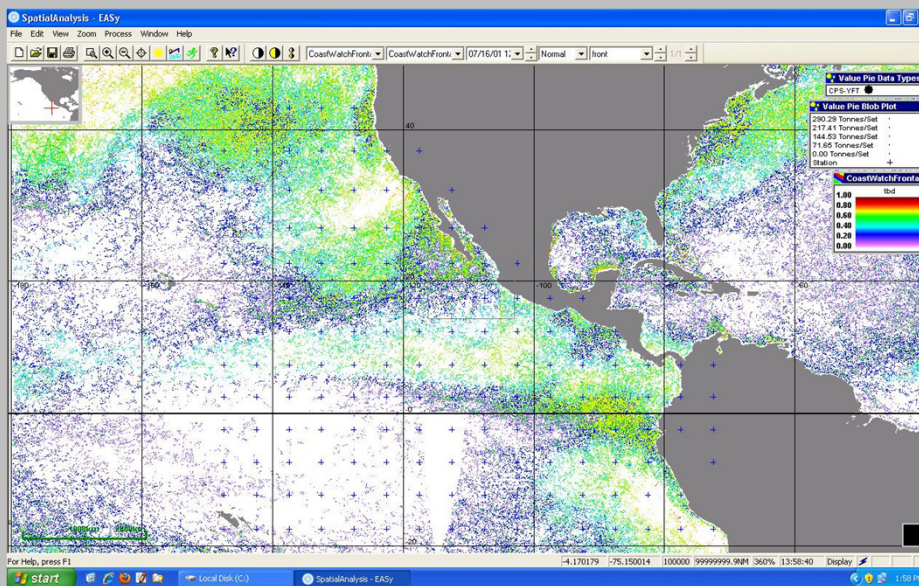
Environmental Characteristics



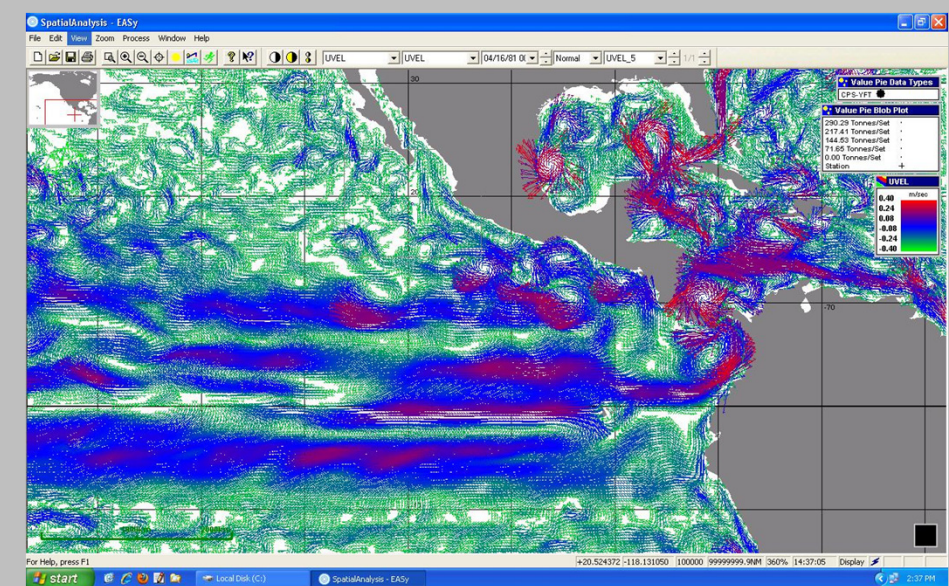
GHR SST Sea Surface Temperature



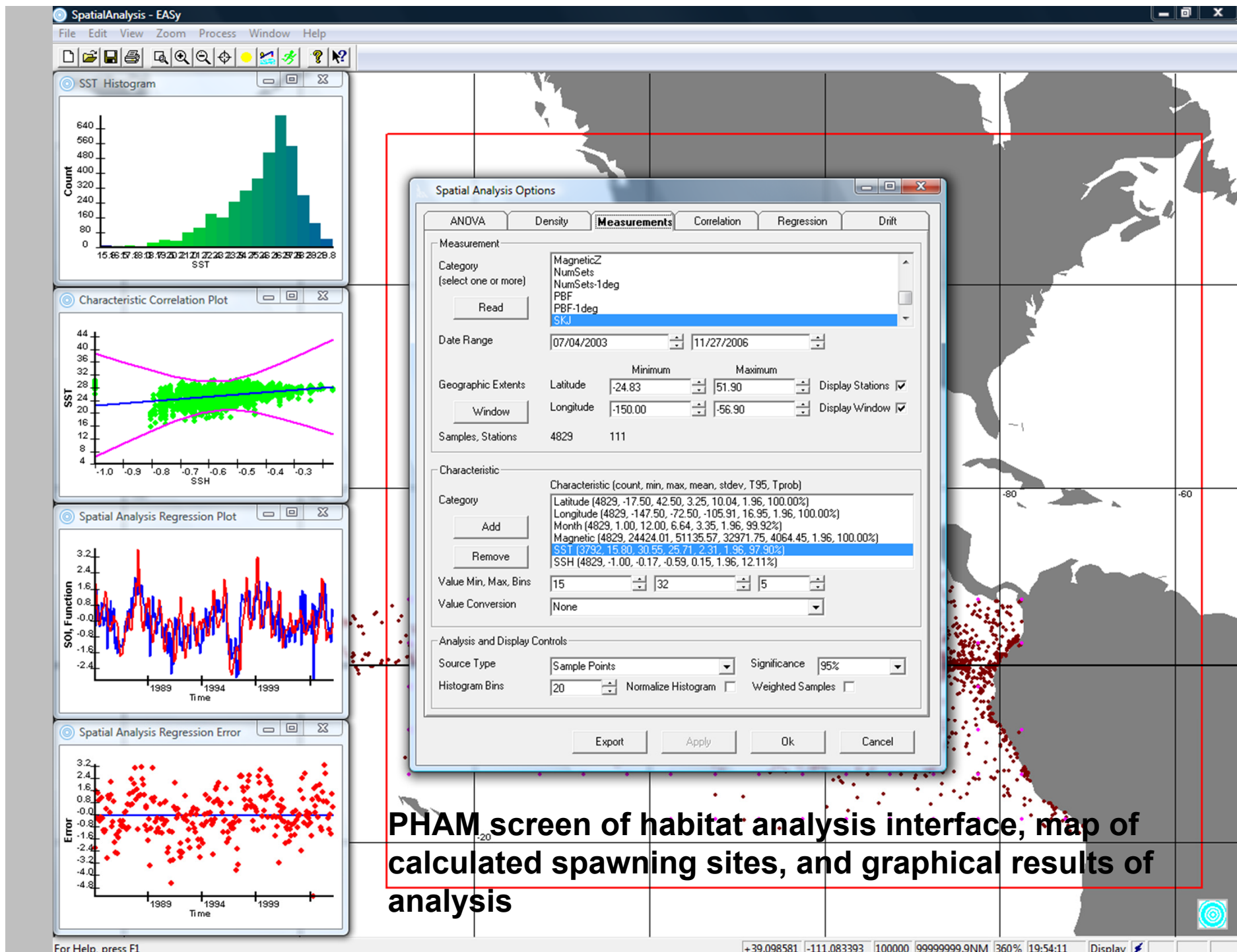
SeaWiFS Chlorophyll



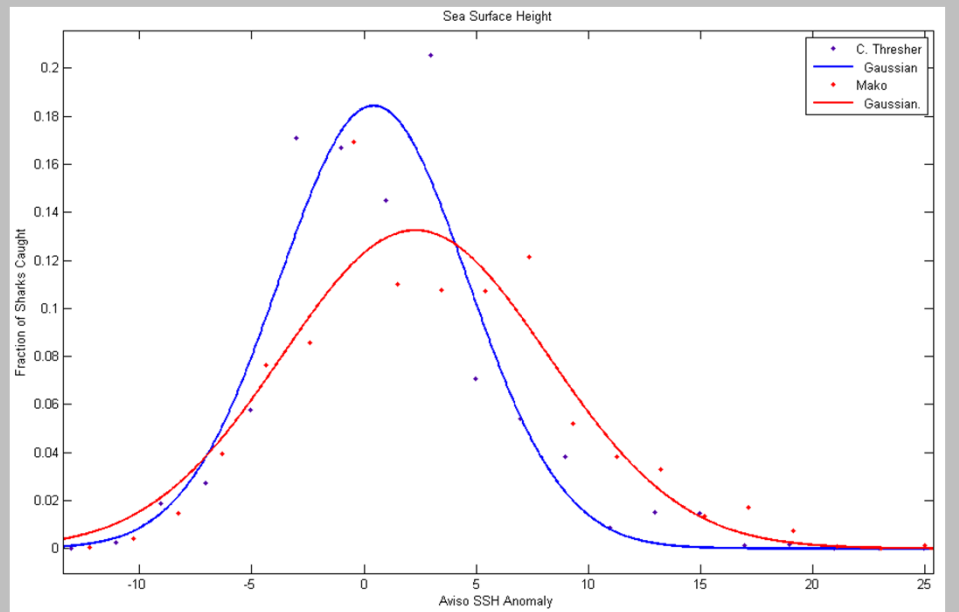
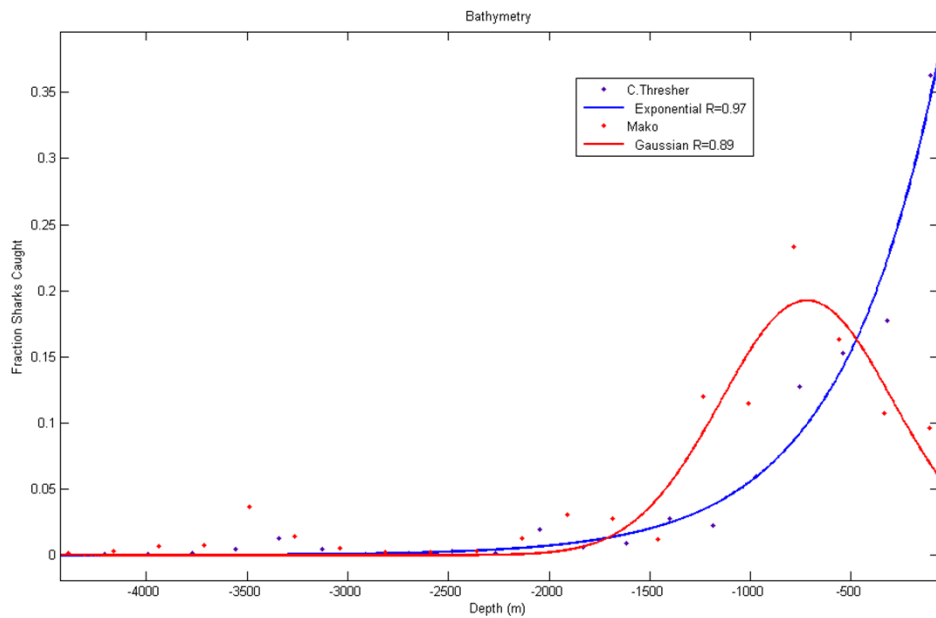
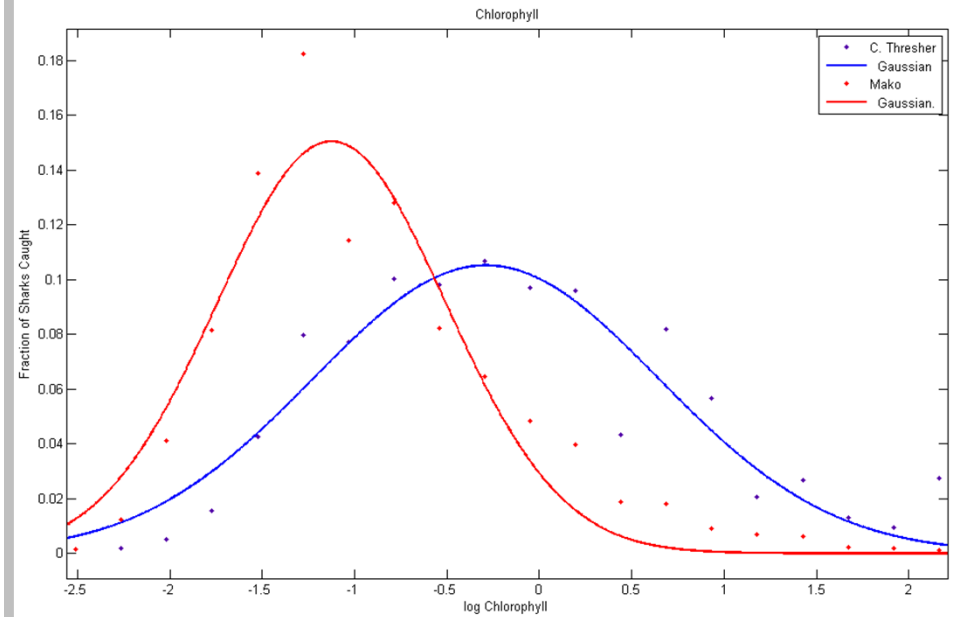
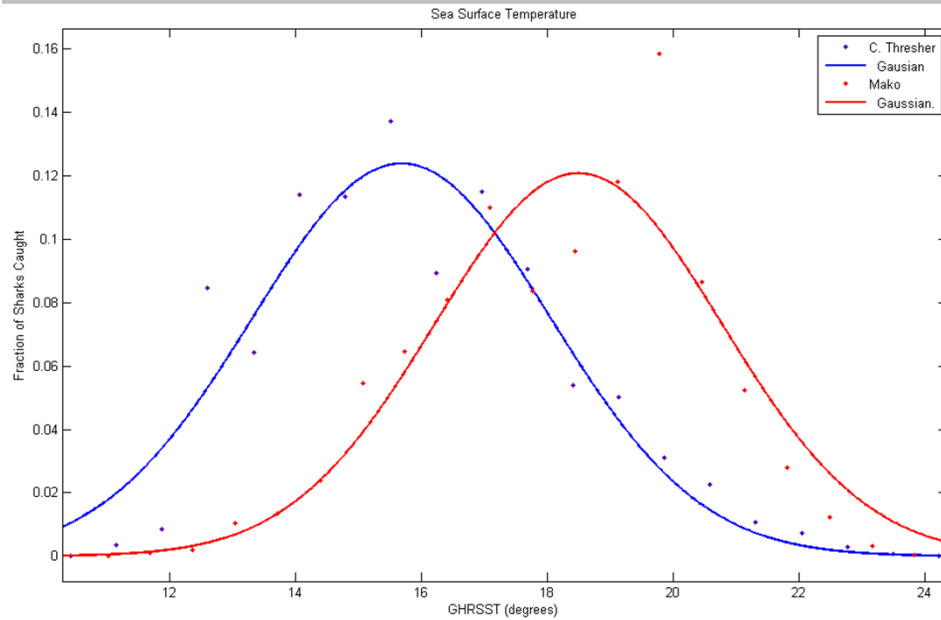
NOAA Coastwatch Frontal Probability



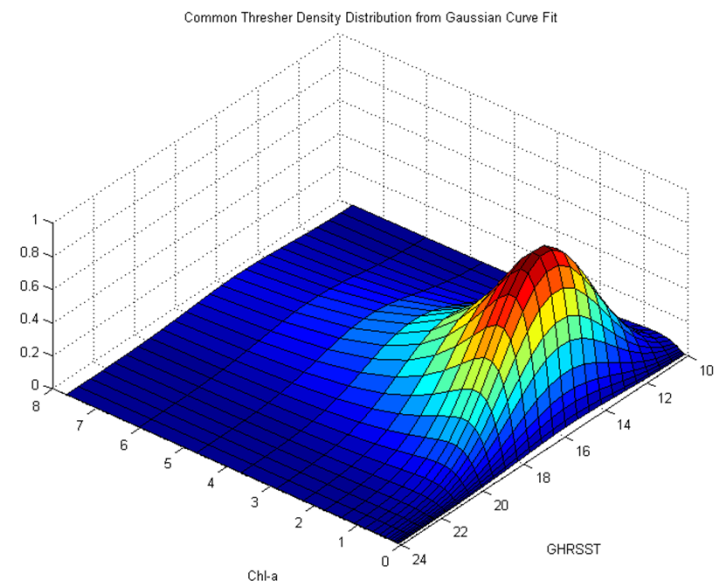
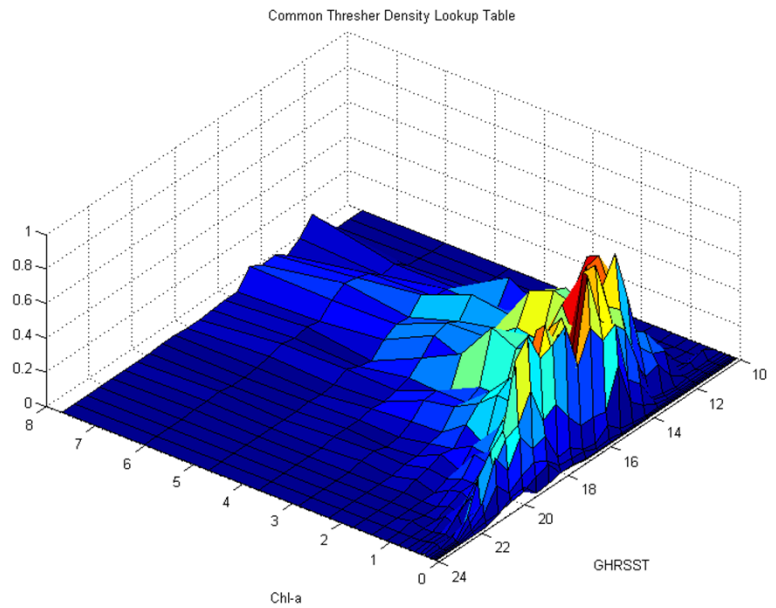
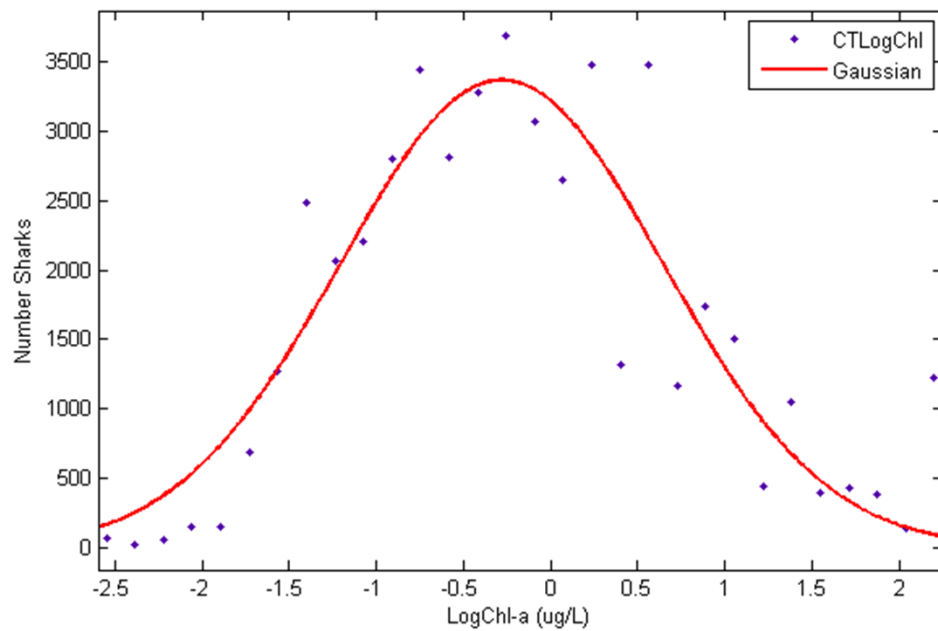
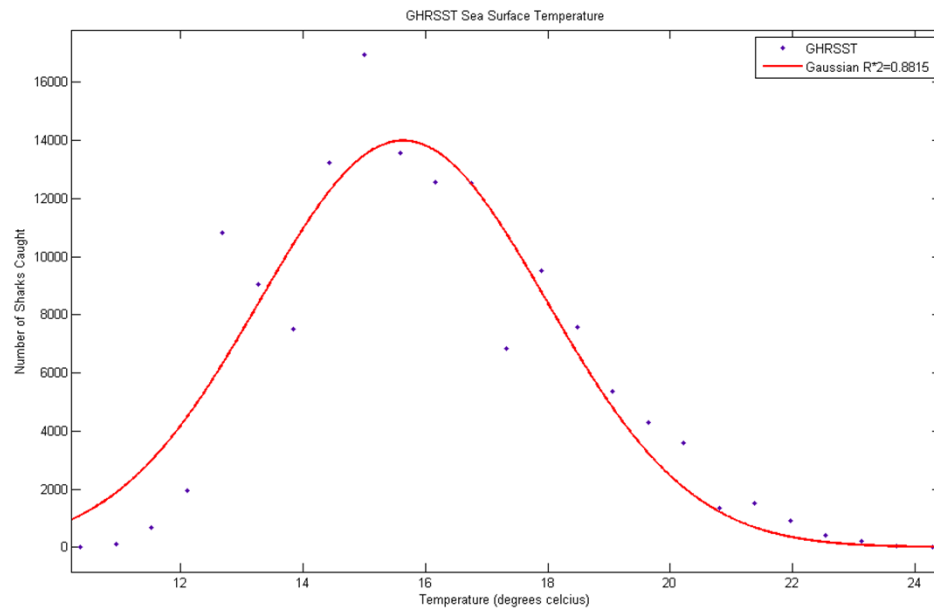
NASA ECCO2 Ocean Currents

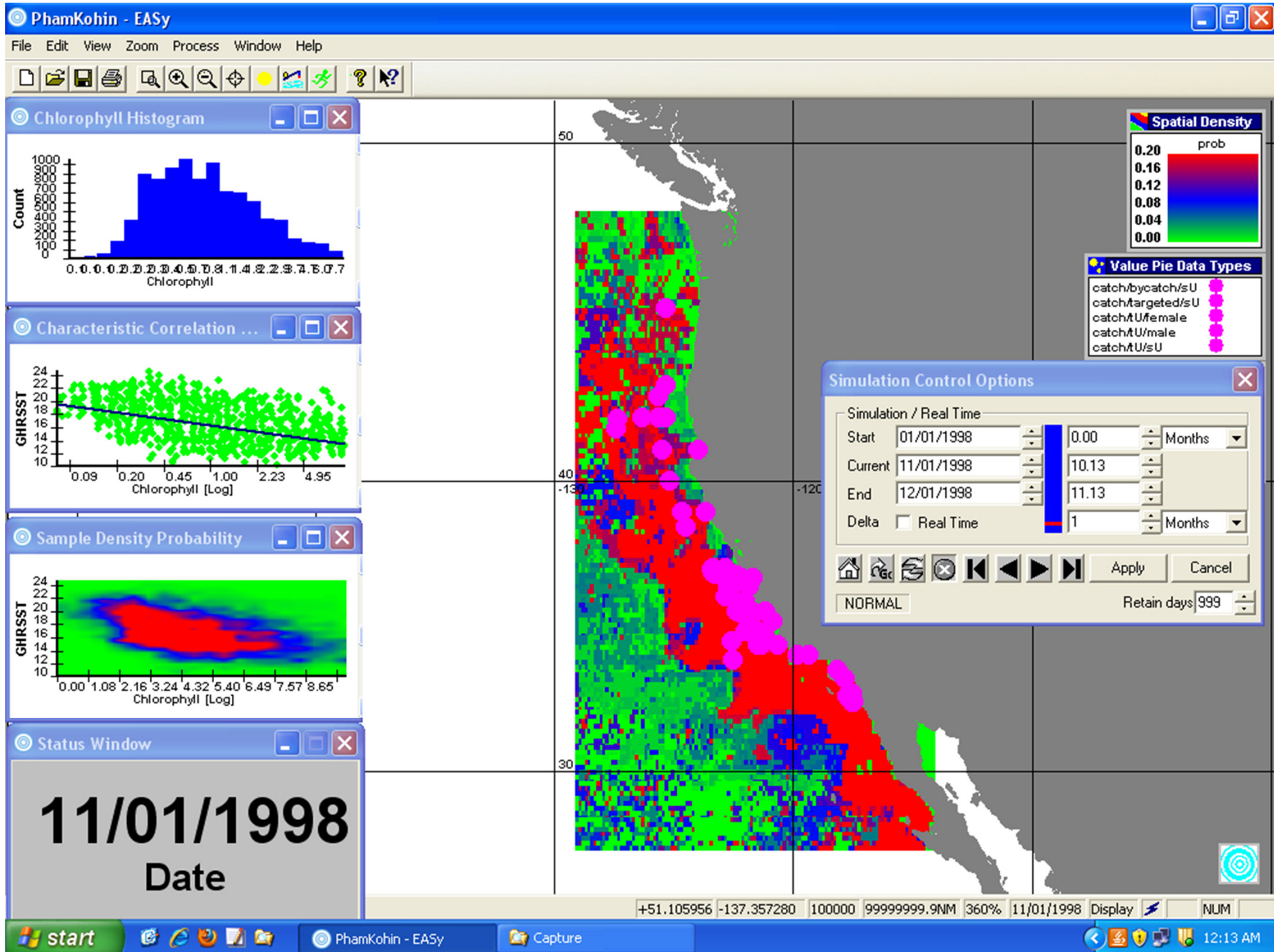


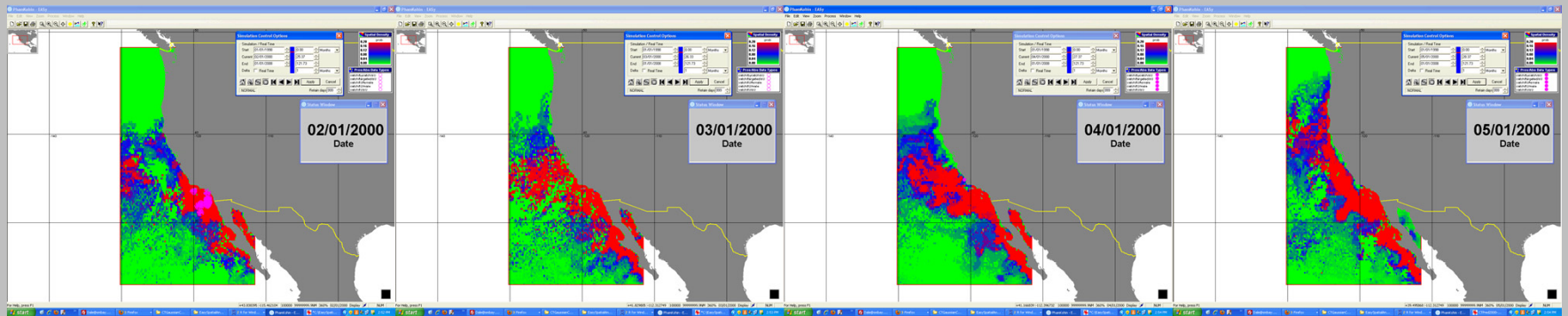
Common Thresher & Mako Shark Analysis



Common Thresher Shark Habitat Mapping





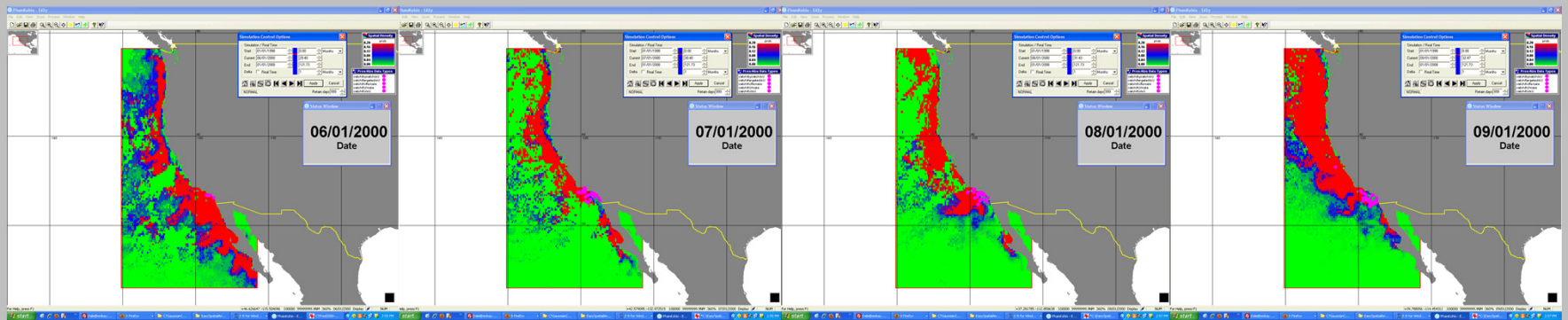


JAN

FEB

MAR

APR

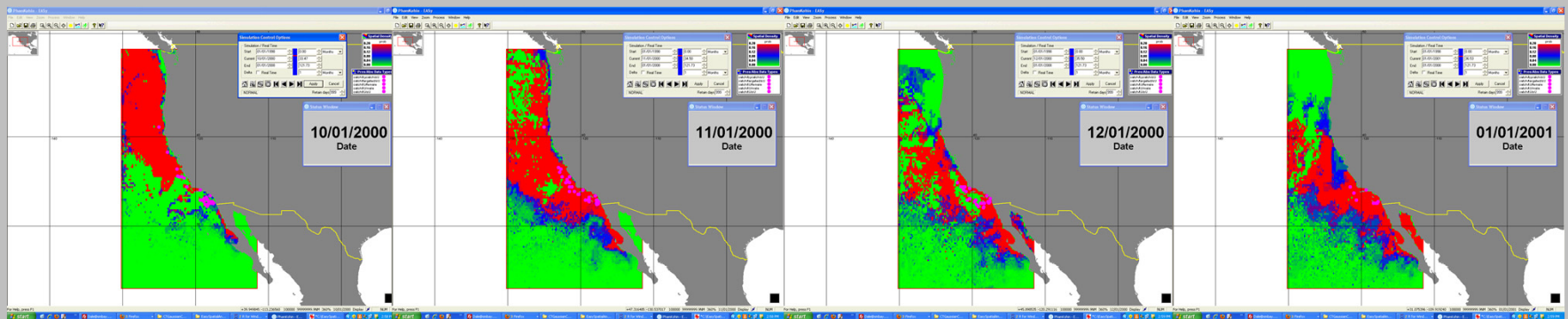


MAY

JUN

JUL

AUG



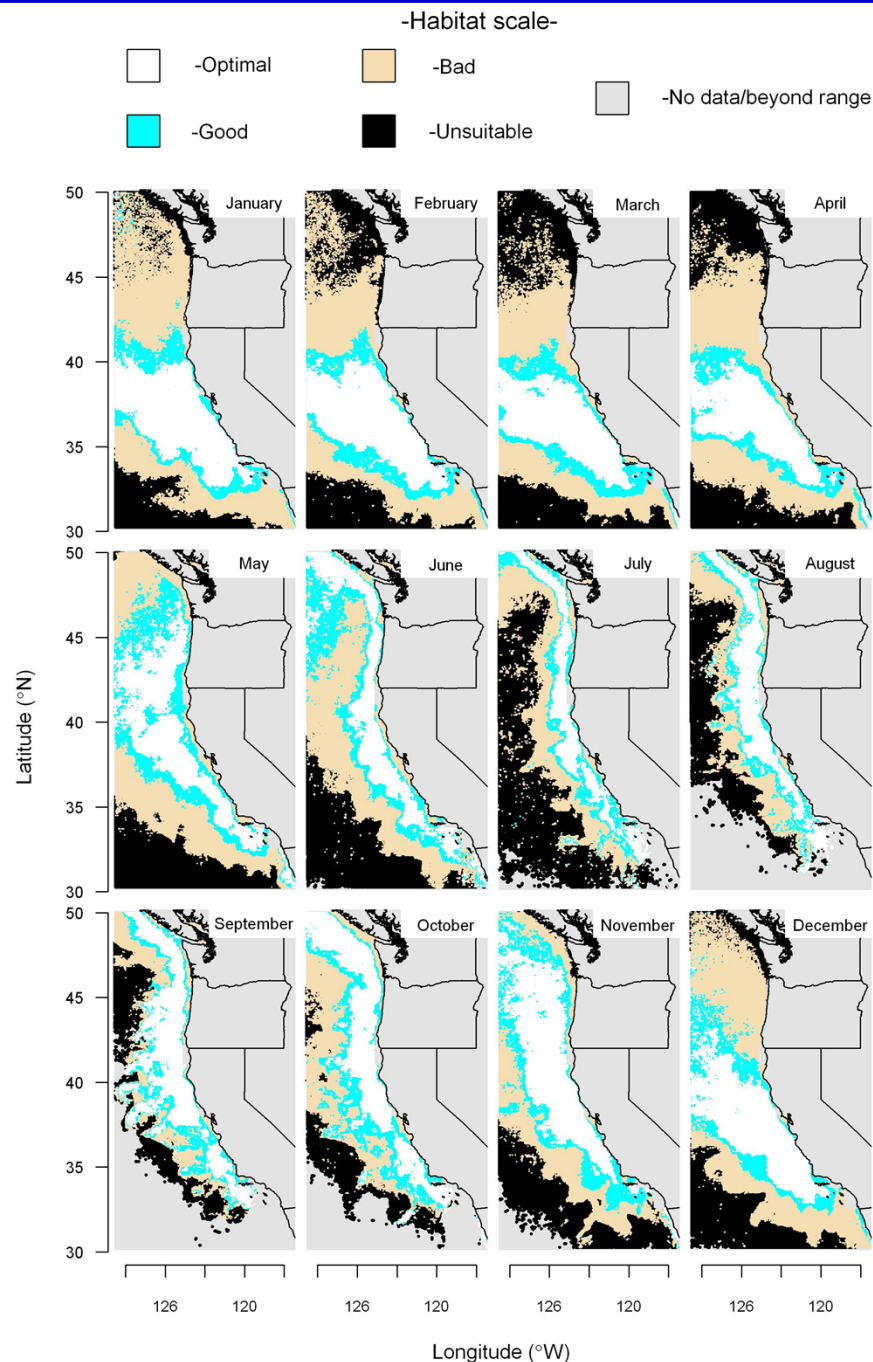
SEP

OCT

NOV

DEC

PHAM Common Thresher Shark Habitat Prediction for 2000
based on chlorophyll and SST



Warm Years: 1998-2009

The habitat scale is derived from a non-linear and multidimensional combination of concurrent sea-surface temperature, chlorophyll concentration and the gradient derived from sea-surface height images.

The pattern described by the seasonal movement of the habitat explains the fisheries patterns of US and Canada and the migrations routes suggested in the 1940's.

Unpublished results kindly provided by Juan P. Zwolinski, Robert L. Emmett, and David A. Demer of the Southwest Fisheries Science Center.

Conclusions

- We have assembled a system that integrates satellite and model output with fisheries data
- We have developed tools that allow analysis of the interaction between species and key environmental variables
- Demonstrated the capacity to accurately map habitat of Thresher Sharks *Alopias vulpinus* & *pelagicus*. Their seasonal migration along the California Current is at least partly driven by the seasonal migration of sardine, key prey of the sharks.
- *If you are interested in using PHAM software (free) please contact kiefer@usc.edu.*

Initial Tasks for this Year

- Incorporate electronic tag tracks for Bigeye and Yellowfin tuna of the Eastern Pacific in order to define the 3 dimension of their habitat.
- Apply PHAM tools to building a stock assessment model for Thresher sharks.
- Build interface between our EASy geographical Information System and R statistics program.